THE EFFECTS OF THE SMART BOARD TECHNOLOGY UTILIZING INTERSPERSAL OF KNOWN ITEMS ON SIGHT WORD RECOGNITION OF STUDENTS WITH READING DISABILITIES

THESIS

Presented in Partial Fulfillment of the Requirements for

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By

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The Effects of the SMART Board Technology Utilizing Interspersal of Known Items on Sight Word Recognition of Students with Reading Disabilities

A Research Project Report

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the Graduate Faculty at the

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TABLE OF CONTENTS

Chapter 1

Introduction

Problem

Learning to read is essential for academic and lifelong success. Reading encompasses a broad range of skills including word analysis, sight word recognition, and comprehension (Browder & Shear, 1996). Norman & Wood (2008) stated children who do not learn to read fluently by first grade are at more of a risk of falling further behind their peers each year. When children fail to attain competent reading skills they are more likely to struggle in other areas of the curriculum. Students, who are at risk of reading disabilities, require instruction that directly targets the acquisition of fluent word recognition skills. Knight, Ross, Taylor& Ramasamy (2003) reported elementary school students with disabilities frequently have reading disabilities that, without intervention, may contribute to persistent academic failure. Knight et al., (2003) also noted sight word instruction is a common intervention for functional literacy, teaching academic words, and providing early learning experiences. The ability to read functional sight words for students with learning difficulties is necessary in order for those students to learn to read (Morgan & Moni, 2007). Students with cognitive and learning disabilities often struggle with reading. They need support and guidance to help them learn to read. Parents and teachers provide the foundational experiences for reading instruction.

In the past two decades, the demand for proficient reading performance has increased. No Child Left Behind has required educators to increase all students' success in readings. Even with the educational goals created at both state and local levels, too many children continue to fail at literacy (Englert, Zhao, Collings & Romig, 2005). Educators need to know what strategies work best for teaching our students to read.

Purpose of Study

The purpose of this study was to determine whether the SMART Board technology, along with theinterspersal of known items, would increase students' with reading disabilities ability to learn and retain sight words. Interspersal of known items is a strategy for teaching students new words by sequencing unknown words with known words (Knight, et al., 2003). A SMART Board is a touch-sensitive screen that connects to a computer and digital projector in order to show images on the screen from the computer (Mechling, Gast,& Thompson, 2007). The SMART Board allows students to use visual, auditory, and hands-on learning techniques in their education. This study was implemented with a small group of students with reading disabilities. These students were pre-tested on words from the Dolch sight word lists and data were gathered as a baseline. Then students were taught unknown sight words while using the interspersal of known items strategy along with the SMART Board technology. The research question that guided this study was: *Will using the SMART Board technology utilizing interspersal of known items increase recognition of sight words with students with reading disabilities?The* following sub-question was also included in the study: *Will implementing interspersal of known items using the Smart Board technology increase the number of sight words students read correctly at a higher percentage as compared to using interspersal of known items alone?*

Background

There is an extensive body of research examining interventions for increasing word recognition for students who are at-risk learners and students with learning and cognitive disabilities. A variety of reading strategies have been researched in order to best meet all

readers' needs (Browder & Shear, 1996). Rivera, Koorland & Fueyo (2002) conducted a study where a student was taught to illustrate a picture prompt to help increase sight word recognition. The researchers found the student was able to increase his sight word recognition with the use of the picture prompts. Peer tutoring and the use of a prerecorded sight word model were successful in teaching sight words to kindergarten at-risk students (Norman & Wood, 2008). The peer tutoring, along with the prerecorded sight word responses, was effective with the struggling readers. Students with cognitive and learning disabilities have been taught sight words and grocery word lists using a variety of teaching strategies including constant time delay and interspersal of known items (Knight et al., 2003). In their study, Knight et al. found constant time delay to be more effective and efficient for students with mild cognitive disabilities. The constant time delay and interspersal of known items were equally effective, but the constant time delay was more efficient for students with learning disabilities. The results suggested interspersal of known items may be more effective for students with learning disabilities than with mild cognitive disabilities. The current study used the interspersal of known items with students with reading disabilities. Browder and Xin (1998) stated that comparing sight word instructional methods can be helpful to teachers of students with learning and cognitive disabilities. If teachers do not have the information of what works best for their students, they may lose valuable instructional time when implementing ineffective strategies. Comparing sight word interventions/strategies is important because they may possibly enhance the use of reading instructional time for teachers of students with disabilities (Knight et al., 2003). These studies all provided educators with an assortment of research based strategies for sight words to teaching students with disabilities. The findings of these studies can help teachers determine strategies to teach their students to be better readers. The current study presented educators with research

based strategies using the SMART Board technology and interspersal of known items and teaching students with learning disabilities sight words.

Interspersal of Known Items as an Intervention

The interspersal of known items strategy has been another successful intervention with students in math, spelling and reading. McDonald and Ardoin (2007) interspersed easy math problems with more challenging problems in order to increase students' preference for worksheet completion and the fluency of completing the math sheets. The researchers found the strategy to be successful with completing math worksheets. Browder and Shear (1996) researched the interspersal of known words strategy with students with disabilities for weather vocabulary words. The results indicated an improvement with the students' word recognition. The interspersal of known items will be incorporated throughout all four phases of this current study.

Technology and the SMART Board as an Intervention

Multi-media including text, photographs and video recordings have been used successfully to teach students with severe cognitive disabilities grocery word lists (Mechling & Gast, 2003). One strategy to teach reading is the computer program *Technology-Enhanced Learning Environments on the Web (TELE-Web)* (Englert et al., 2005). The study focused on determining the effects of the program on early reading performance and word recognition. The researchers found success with the increase of reading sight words for most students. Four of the five students were able to demonstrate an accelerating trend in their reading. The students were able to increase their sight word recognition from 42% to 80%. The researchers then expanded the TELE-Web intervention to the entire first grade class. The class was able to demonstrate a

dramatic boost in their reading achievement. Some students were demonstrating a 1.5 month of reading gain per month of reading instruction.

The SMART Board technology has been effective in teaching students with moderate intellectual disabilities. Mechling, Gast and Krupa, (2007) focused on the SMART Board technology and a three second constant delay strategy to teach grocery words to the students. The researchers addressed the successfulness of students' learning each other's words in the small group setting. Their results supported the use of the SMART Board technology with teaching multiple students at one time. The SMART Board technology was also effective on the observational learning of the other students' words.

Technology has been effective in teaching students who are struggling with reading. Some of this technology has included computer programs(Englert et al., 2005), multi-media (Mechling & Gast, 2003), and pre-recorded sight words (Norman & Wood, 2008). While there is a substantial body of literature that explores the use of interspersal of known items (McDonald & Ardoin, 2007 & Browder & Shear, 1996) due to the novelty and only recent introduction of SMART Boards to the class room landscape, there is extremely limited examination of their benefits for children with reading disabilities. This study will expand the research on the use of the SMART Boardand sight word instruction.

Definitions

- Interspersal of Known Items - Sequencing known words with unknown words (Knight et al., 2003)
- SMART Board - An interactive white board

- Dolch Sight Words - A list of words frequently read by students. These words may or may not be decodable.

Summary

Children need to learn to read in order to have academic and lifelong success. They need to learn the skills encompassed in reading skills including word analysis, sight word recognition and comprehension (Browder & Shear, 1996). Children who are not learning to read fluently by first grade are at a higher risk of falling behind their peers (Norman & Wood, 2008). Sight word instruction is a common intervention for functional literacy, teaching academic words and providing early learning experiences (Knight, et al., 2003). In order for students with disabilities to learn to read, they need the ability to read functional sight words (Morgan & Moni, 2007). The purpose of this study was to determine the effectiveness of incorporatingthe interspersal of known items strategy with the SMART Board technologyin order to increase students' with cognitive and/or learning disabilities ability to learn and retain sight words. The research question that guided this study was: *Will using the SMART Board technology utilizing interspersal of known items increase recognition of sight words with students with reading disabilities?The* study was implemented when students learned sight words from the Dolch word lists using interspersal of known items and then added the SMART Board technology with the approach. The following sub-question was also included in the study: *Will implementing interspersal of known items using the Smart Board technology increase the number of sight words students read correctly at a higher percentage as compared to using interspersal of known items alone?*

Chapter II

Literature Review

This study incorporated the SMART board technology with the interspersal of known items in order to determine their combined effectiveness of increasing sight word recognition for students with reading disabilities. A gap exists in research for integrating the SMART Board technology with students with reading disabilities. Due to this lack of research, the following literature review will focus on strategies that have been effective for teaching at-risk readers and students with disabilities sight words (Englert et al., 2005, & Norman & Wood, 2008, Mechling & Gast, 2003). These strategies will include other areas of technology besides SMART Board as well as studies using the interspersal of known items. The non-SMART Board technology will be reviewed first. The interspersal of known items technique and supporting research will then be explained including how it has been used for reading (Joseph & Nist, 2006; Schmidgall & Joseph, 2007) and spelling (Cates, Skinner, Watson, Meadows, Weaver,& Jackson, 2003). Research on the SMART Board and teaching reading (Mechling et al., 2007) will also be included. The need for the current study will then be presented.

Technology and Teaching Reading Words

Englert et al.(2005) conducted a study using internet based software to improve students' reading abilities. The study consisted of two design experiments. The first group consisted of four students at risk of retention and reading disabilities in a first grade classroom. The second group included an entire first grade class. Both groups used internet-based software from the TELE-Web project. The TELE-Web software used worked on increasing students' word

recognition through a cloze activity. Words students had originally read incorrectly appeared in short passages that included five sentences. Each sentence contained one of five target words. Students could have the sentences read to them by choosing a "read" button. The intervention was successful, overall, with the students who were at risk of retention and reading disabilities as their accuracy of reading words improved. Their ability to transfer their success to a standardized measure of reading performance was also demonstrated in the study.

Multi-media programs have been studied when teaching students with mild to moderate intellectual abilities grocery word associations and the location of target items at grocery stores (Mechling & Gast, 2003). The grocery store was video-taped along with having pictures taken of the store. These videos and pictures were used in teaching the students nine grocery store target words on a lap top computer. The students then went into the store to look for items on a list provided for them. The results indicated the simulated instruction was successful when the three students were all able to match the target grocery store words with the words on a grocery store aisle sign. Although this strategy was successful for teaching grocery store words, it does not appear to be easily transferable to teaching sight words to students with disabilities.

Another study incorporating a low technology device was conducted by Norman and Wood (2008) who used peer tutoring and prerecorded sight words (a low technology device) with kindergarten students who were at risk readers. The students were from the same regular education class and received additional reading support. Students were taught sight words that were phonetically irregular. The students were first trained to be peer tutors during a three-week period. The researchers found all of the students had higher percentages of sight words read when the voice output device was used in addition to their word cards. While this study was successful, limitations may include the time constraints of teaching students to be peer tutors.

These studies using different forms of technology have been successful in teaching at-risk students and students with disabilities sight words and grocery store words. Englert et al., (2005) demonstrated the use of an internet based software along with flashcards and picture prompts a useful strategy for teaching at-risk readers words. The students were also able to transfer their reading success to a standardized measure of reading performance. Mechling et al., (2003) established that using multi-media such as videotaping and photographshave been successful at teaching students with cognitive disabilities grocery store words. Norman and Wood (2008) used pre-recorded sight words on a voice output device as a form of technology to successfully teach words to at-risk kindergarteners. All of these studies demonstrate different forms of technology can be useful in teaching students how to read new words. The current study incorporates the SMART Board as a form of technology to teach sight words to students with reading disabilities.

Interspersal of Known Items

The interspersal of known items has been successful with students in the areas of reading and spelling. Browder and Shear (1996) researched interspersal of known items to teach functional words to students who had moderate intellectual disabilities and severe behavior disorders. The students were learning words that would be often found in a newspaper weather report. In addition to the Interspersal strategy, a five-step error was used when a student read a word incorrectly or did not respond. In this procedure the first step involved the teacher said the word correctly. Next, the teacher asked the student to repeat the word while looking at the model. In the third step the teacher asked the student to trace each letter while spelling the word

aloud. Then the teacher used the word in a sentence and said the word. Finally the teacher had the student read the word while looking at it. The researchers found the students were all able to learn the new 10 sight words. Those students had previously learned 30 words after years of schooling. The researchers stated learning the 10 words in six weeks or less was quite significant.

Cates et al., (2003) investigated the effects of the interspersal method along with traditional drill and practice for teaching spelling. The researchers wanted to know the cumulative learning of students' spelling skills along with a student-learning rate. The participants included five general education students who struggled with spelling. The three conditions of the study included students given six unknown words to spell in one condition, the second condition included the six unknown words along with three additional known words, and the final condition included eighteen additional known words with the six unknown words. The findings of the study conclude that all three conditions are effective for students learning to spell more unknown words correctly. This study, however, demonstrated the traditional drill and practice was more efficient in students spelling more new words correctly.

Similar to the Cates, et al. (2003) study, Joseph and Nist (2006) compared the effects of unknown-known ratios on reading words and learning rates. The researchers studied two fifth grade and one six grade students in regular education who had difficulties with reading words. The study students participated in three different experimental conditions. The first condition had students reading six unknown to eighteen known words. The second condition had the students reading three known words interspersed after every third unknown word. The final condition was traditional drill and practice where students read six unknown words without any known words. The researchers found the students would learn more words per minute of

instructional time using the drill and practice method. Overall the students as a group mastered more unknown words using the interspersal method from the condition of having the higher number of known words than unknown words.

Schmidgall and Joseph (2007) also compared interspersal of known words with traditional drill and practice along with a phonic analysis involving word boxes. Six first grade students who were in need of intensive intervention for reading were the participants. The researchers used four different patterns of phonetic words (CVC, CVCV, CVVC, and CVCC). Six unknown words were presented for each session. The interspersal training included three known words with the six unknown words. The traditional drill and practice did not include any known words nor did the phonic analysis condition. This phonetic analysis condition involved students learning words through boxes drawn on dry erase boards. Each box would represent a sound in each word (ex. cake would have three boxes). The results of this study concluded students had increased word performance in each of the conditions. This study used a 33% to 67% ratio of known to unknown with the interspersal condition and concluded this ratio was not as effective in this study. The researchers suggested further studies use a 50% to 50% ratio as this has been more successful in previous studies they had researched.

The studies of Cates et al. (2003), Joseph and Nist(2006)and Schmidgalland Joseph (2007) all included the interspersal of known items in their research. They found the strategy to be successful for teaching students to read and spell; however, their research also focused on instructional efficiency, which was not as effective with the interspersal method. These studies are important to the current study as they support the use of the interspersal of known items strategy for teaching spelling and reading. The current study focused on the effectiveness of the

interspersal method and SMART Board technology for teaching sight words to students with reading disabilities.

SMART Board Technology

Limited research has been conducted using the SMART Board technology with students with learning and/or cognitive disabilities. Mechling et al., (2007) researched the SMART Board technology to teach sight words along with a 3 second constant time delay strategy to three students with moderate intellectual disabilities. The researchers wanted to know if teaching sight words using the SMART Board technology would be efficient for learning sight words and if the students would learn a higher percentage of the other group members' words. The functional sight words included words from a grocery store. Students were given three unknown words for flash card instruction and three unknown words for the SMART Board instruction during the study. The results of the study support observational learning of other students' target words during small group instruction. It was also effective for students learning their own words.

Summary

In summary, the purpose of the current study was to determine if using the SMART Board technology along with the interspersal of known items would increase the ability to read sight words for students with reading disabilities. The need for this study is important because, although there is support in literature regarding the interspersal of known items and also various forms of technology in teaching sight word recognition to students with reading disabilities, the research is inadequate in regards to the SMART Board technology as a strategy for reading instruction. This study will expand on the research of the SMART Board technology. This

literature reviewed a variety of strategies to teach students with disability sight words, vocabulary and/or grocery word lists. Interspersal of known items has been successful in teaching students who are at-risk and with disabilities reading and spelling. Cates et al(2003), Josephand Nist(2006), and Schmidgalland Joseph(2007) all found interspersal of known items to be an effective strategy for reading and spelling instruction. This research was important for the current study due to the use of the interspersal of known items in each phase of the study. Technology including TELE-Web software (Englert et al., 2007), video recordings (Mechling & Gast, 2003), and pre-recorded sight words (Norman & Wood, 2008) have been successful in teaching word recognition and sight words to at-risk students and students with disabilities. The research, however, in using SMART Board technology is quite limited. The current study was conducted in order to increase research on SMART Board technology as a strategy for teaching sight words to students with reading disabilities.

Chapter III

Methods

The focus of this study was to investigate whether the inclusion of the SMART Board technology with interspersal of known items would increase sight word knowledge for students with reading disabilities. This study was important as it addresses a gap in research for integrating the SMART Board technology with special education students. In addition, the study may provide special education teachers with new insights about the effects of the SMART Board technology as a research based strategy. The research question that guided this study was: *Will using the SMART Board technology utilizing interspersal of known items increase recognition of sight words with students with reading disabilities?* In order to address the research question, a quantitative, single subject ABAB design was implemented to study students learning of sight words from the Dolch sight word lists using interspersal of known items and then adding the SMART Board technology with the approach. The following sub-question was also included in the study: *Will implementing interspersal of known items using the Smart Board technology increase the number of sight words students read correctly at a higher percentage as compared to using interspersal of known items alone?*

Participants

The participants in this study were two second grade students (n-2) and two third grade students (n-2) from an elementary school in northern Minnesota (see Table 1). The research question was intended to determine if the use of SMART Board technology would enhance the sight word recognition of students with educational learning disabilities in reading. Study participants included one second grade male who was cognitively disabled and received reading support from the special education teacher, a second grade female with a learning disability in reading, a third grade female who received reading support under the Other Health Disabilities category, and a third grade male who had a reading disability. All four participants were Caucasian. The participants attended daily special education reading class for forty-five minutes each day in a resource room. The students received reading instruction at their reading level from the special education teacher in a small group setting. The researcher of this study was the special education teacher for this classroom.

Table 1. Description of Participants

Participant	Gender	Grade	Age	Special Education Category
P1	Female	Second	Seven	Specific Learning Disability
P2	Male	Second	Eight	Developmental Cognitive Disability
P3	Female	Third	Nine	Other Health Disability
P4	Male	Second	Nine	Specific Learning Disability

Setting

The study took place in a small town in Northern Minnesota. The elementary school included grades kindergarten through third. The entire district had over 2000 students with the elementary school having just under 600 students. The elementary school had approximately 65 students receiving special education services. The elementary school had six sections of each grade level. Three kindergarten sections attended school full days every other day. The other three kindergarten sections attended school all day every day. The school included twenty-four classroom teachers, two full-time special education teachers, and two part-time special education teachers. In addition to the special education teachers, staff included a full-time speech pathologist and a part-time speech pathologist. Other related special education services, such as occupational therapy and physical therapy, were contracted from a nearby special education cooperative.

The research took place in a special education resource room arranged with a teacher desk and a table for small group instruction. Two student computers, two additional tables, and a desk with a study carrel were also in the room as independent work spaces. A small, carpeted area was included where students could read quietly or complete work independently. During the pre-assessments, baseline phases, and post-assessment, each participant would sit at a table with the researcher when reading words to the researcher. The other participants in the class would be working at the other areas in the classroom on independent reading assignments. The participants would also work in those other areas completing independent reading assignments during the intervention phases. The participant would then stand near the SMART Board for his/her turn to read words on the SMART Board.

Materials and Procedures

The University of Minnesota Institutional Review Board (IRB) and the school, in which the study was conducted, approved all procedures used for the current study. Materials included flash cards, PowerPoint, and the SMART Board technology. The study included a pre-assessment, four weeks of both baseline and intervention phases, and a post-assessment (see Table 2). Each participant began the study by reading words from the Dolch pre-primer to fourth lists to determine known (K) and unknown (U) words. The study incorporated four phases with each phase lasting one week. During each phase of the study, the words were presented in the following order: 2K, 1U, 2K, 2U, 1K and 2U. Each day the words were arranged in the same known and unknown format, but the sequence of the words was altered each day in order to avoid participants memorizing the words in a certain order. A baseline condition was conducted over a one-week period when each participant was presented ten words (five known (K) words and five unknown (U) words) on flash cards. After each word was presented, it was recorded whether the participant read each word correctly or incorrectly on a spreadsheet that contained each sight word. After the baseline phase, the intervention of the SMART Board technology was put into place.

During the intervention phase, the participants were again exposed to ten words (five known words and five unknown words) on PowerPoint slides. Each slide had a different word in the following order: 2K, 1U, 2K, 2U, 1K, and 2U. The procedure was similar to the Mechling, Gast, and Krupa (2007) study in which a different PowerPoint slide was created for each set of ten words, so the order of the words could be rearranged. After reading a word aloud, the

student would touch the screen to advance to the next slide. The spreadsheet was used to record whether the participant read the words correctly or incorrectly. Participant responses were recorded on the spreadsheet. After one week of working with the SMART Board, the intervention was withdrawn, and participants were introduced to a new set of ten words with flash cards following the same format as during the baseline. This intervention withdrawal phase continued for one week. The final phase, lasting one week, reintroduced the SMART Board technology intervention continuing with the same format as during the first intervention phase. Each participant reread the same words from the Dolch word lists in order to measure his/her sight word knowledge at the end of the study. Table 2 displays the procedures of the study including the pre-assessment, four phases and post-assessment.

Table 2. Procedures of the study

When	What occurred
One week prior to phases	Pre-assessment of Dolch sight word lists
Week 1	Baseline phase with flash cards
Week 2	Intervention phase with SMART board
Week 3	Reversal baseline phase with flashcards
Week 4	Intervention Phase with SMART board
One week after phases	Post-assessment of Dolch sight word lists

Data and Data Collection

This study utilized a quantitative, single subject ABAB design. The interspersal of known items and SMART Board technology were the independent variables. The number of sight words read correctly for each participant was the dependent variable. Data were collected on each participant when asked to read words from the Dolch sight words prior to the intervention. The words read correctly and incorrectly were recorded on a spreadsheet for each participant for each phase of the ABAB design. During each phase of the study, data were recorded daily on the number of words read correctly out of ten possible for each participant. At the end of all the phases, the participant read words from the Dolch sight words lists to determine the percentage of unknown words read correctly post intervention.

Data Analysis

Data were collected and recorded on each participant's daily performance on the number of words read correctly out of ten possible. Graphs were used to analyze each participant's number of words read correctly. The X axis represented the days while the Y axis represented the number of words read correctly. Visual analysis (Krishef, 1991) was employed to interpret graphs and changes of participant performance. Data were also collected and recorded post-intervention. Each participant was re-assessed on the Dolch word lists from the pre-intervention assessments. Graphs wereanalyzed to determine the percentage of unknown words read correctly from the post-assessment. The X axis represented the days, and the Y axis represented the percentage of unknown words read correctly.

Chapter IV

Results of the Study

The purpose of this section is to report the results of the research project. The results will highlight the effects of the SMART Board technology incorporated with the interspersal of known items strategy on sight word recognition. All participants demonstrated an increase of the number of words known that were previously unknown. The SMART Board technology was not more effective than when students used flash cards alone with the interspersal of known items.

Implementation of SMART Board technology

The purpose of this study was to determine if using the SMART Board technology would enhance sight word recognition for students with reading disabilities when integrated with the interspersal of known items. Students were pre-assessed on the Dolch sight word lists. Forty words were chosen from the lists (see Table 3). Of the forty words, twenty were words the participant read correctly, and the other twenty were words each participant did not read correctly. During the first and third weeks of the study, the participants read ten words with flash cards. The SMART Board technology was implemented with ten words during the second and fourth weeks. Participants were then re-assessed on the Dolch word lists after the four weeks.

Table 3. Dolch Words For Each Participant

Participant	Week 1 Words	Week 2 Words	Week 3 Words	Week 4 Words

P1	and*	am*	had*	sit*
	big*	he*	just*	us*
	said	there	after	sing
	little*	no*	stop*	bring*
	the*	pretty*	then*	hot*
	where	could	around	wash
	brown	round	both	far
	you*	so*	fast*	if*
	saw	walk	cold	myself
	please	because	goes	together
P2	go*	he*	an*	or*
	not*	on*	by*	sit*
	where	ate	thank	sing
	and*	she*	her*	cut*
	red*	under*	him*	if*
	black	there	walk	upon
	am	could	been	which
	to*	will*	open*	six*
	pretty	going	cold	far
	came	take	goes	full
P3	can*	big*	but*	by*
	and*	for*	do*	her*
	three	one	came	want
	in*	it*	like*	just*
	me*	look*	on*	over*
	here	red	new	with
	is	where	ran	an
	to*	not*	she*	stop*
	run	am	ride	had
	find	ate	saw	his
P4	at*	can*	gave*	got*
	ran*	in*	best*	if*
	with	where	sit	show
	funny*	me*	or*	pick*
	red*	to*	these*	today*
	want	could	us	start
	well	thank	use	address
	and*	you*	wish*	also*
	but	them	far	bad
	our	many	then	began

Note. The * indicates words known.

Table 3 displays the words each participant read during the four phases of the study. Each participant read words from weeks one and three with flash cards utilizing the interspersal of known items strategy. The participants read words from weeks two and four on the SMART board technology in addition to the interspersal of known items strategy.

During each phase of the study the participants read five known and five unknown words. Each week the numbers of correct words read correctly were recorded (see Graphs 1-4). The average numbers of words read correctly for each phase of the study were calculated. The numbers of words read correctly for the last day of each phase was also recorded.

Figure 1

Participant 1's Words Read Correctly During Each Phase

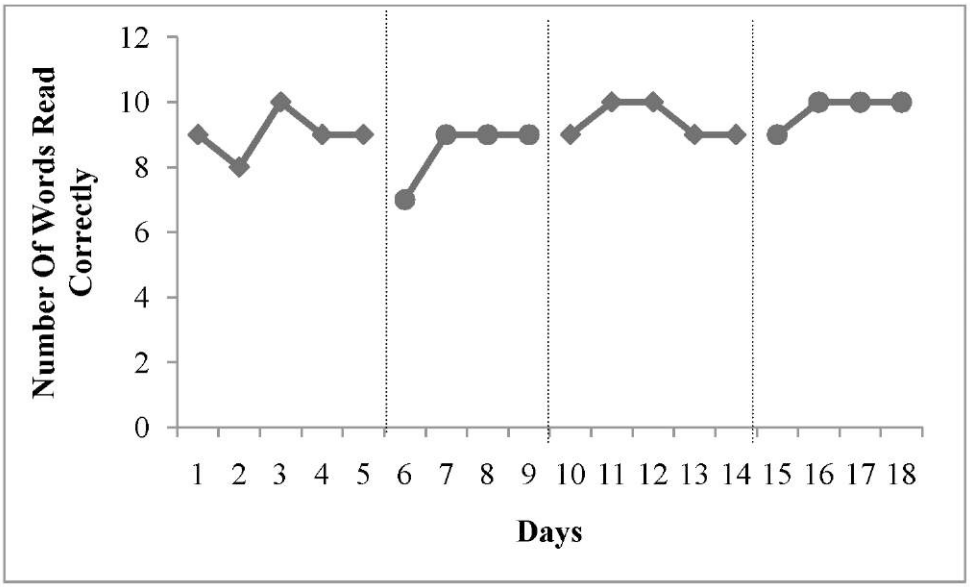

Figure 1 displays the words read correctly during each phase of the study for Participant 1. During the baseline and reversal baseline phases, the participant averaged 90% and 94% accuracy on words read correctly. The participant averaged 85% and 87.5%accuracy on words read correct throughout the intervention phases. This participant had a higher average of words

read correctly during weeks using the flash cards as opposed to the treatment with the SMART Board technology. During both phases with the flash cards, the participant read eight words correctly on the last day. She read eight correctly words on the last day of the initial SMART Board phase and nine words correctly on the last day final SMART Board phase.

Figure 2

Participant 2's Words Read Correctly During Each Phase

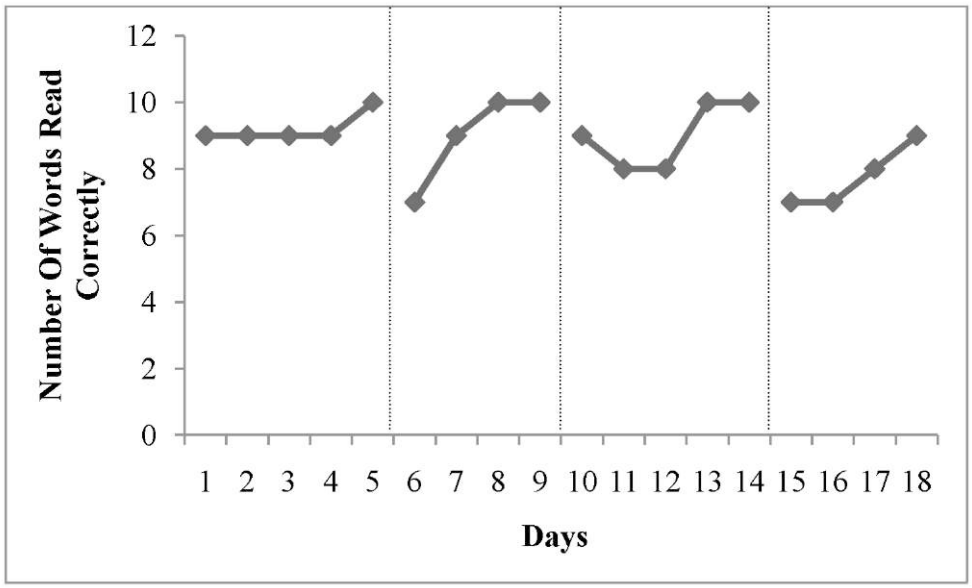

Figure 2 displays the number of words read correctly by Participant 2. He read words correctly during the initialphase with 95% accuracy and read with 90% accuracy during the reversal baseline. He had 90% accuracy during the first treatment phase and 77.5% accuracy during the second treatment phase. During both phases with the flash cards, the participant read ten words correctly on the last day. He read ten words on the last day of the initial SMART Board phase and nine words correctly on the last day final phase with the SMART Board.

Figure 3

Participant 3's Words Read Correctly During Each Phase

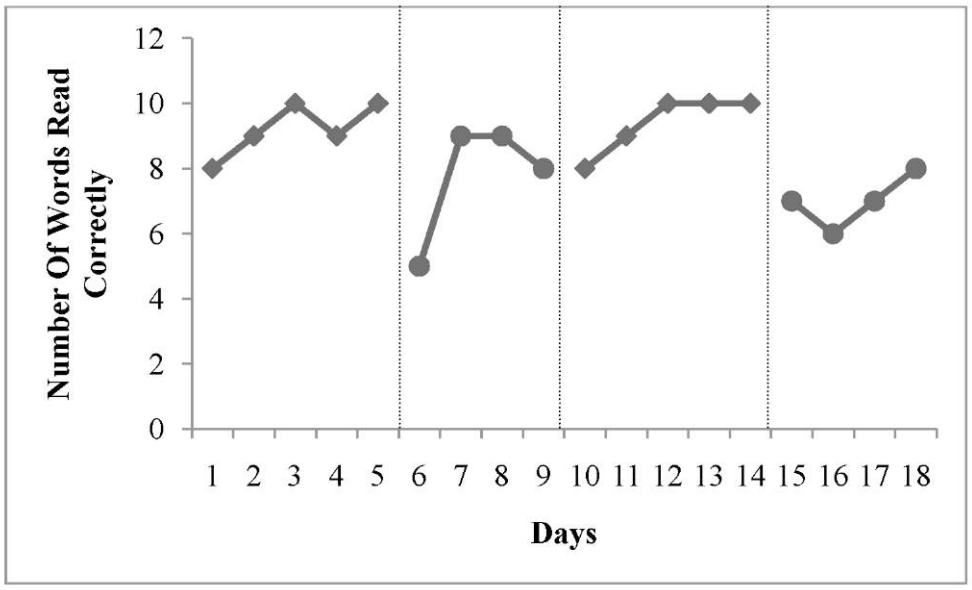

Figure 3 displays the words read correctly for Participant 3 during the four weeks of the study. She read with 92% accuracy during the baseline phase and with 94% accuracy during the reversal baseline phases. She read with 70% accuracy during both intervention phases. During both phases with the flash cards, the participant read ten words correctly on the last day. She read eight words on the last day of both SMART Board phases.

Figure 4

Participant 4's Words Read Correctly During Each Phase

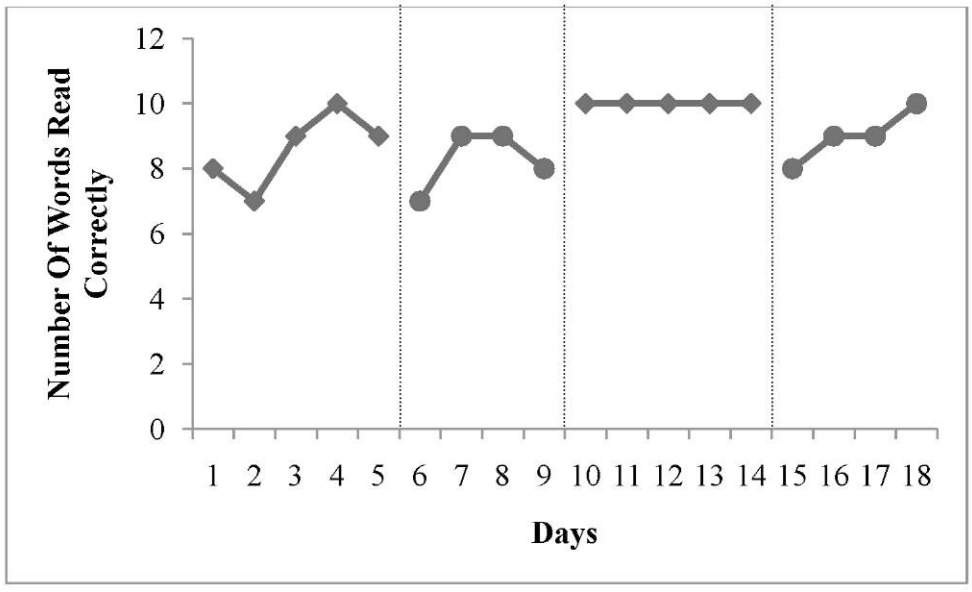

Figure 4 displays the words read correctly for Participant 4 during the four phases of the study. He averaged 86% accuracy for the words he read during the baseline phase and 100% during the reversal baseline phase. Participant 4 averaged 82.5% accuracy on the words he read correctly during the initial treatment phase and 90% accuracy during the second intervention phase.During the first phase with the flash cards, he read eight words correctly on the last day. He read nine words correctly on the last day of the second flash card phase. She read eight words on the last day of the initial SMARTBoard phase and ten words correctly on the last day final phase with the SMART Board.

Data were collected and compared between the pre- and post-assessments (see Graphs 5-8). The percent of words read correct (number of words read correctly divided by the number of words read altogether) were calculated on plotted on graphs.

Figure 5

Participant 1 's unknown words read correct during the post-assessment

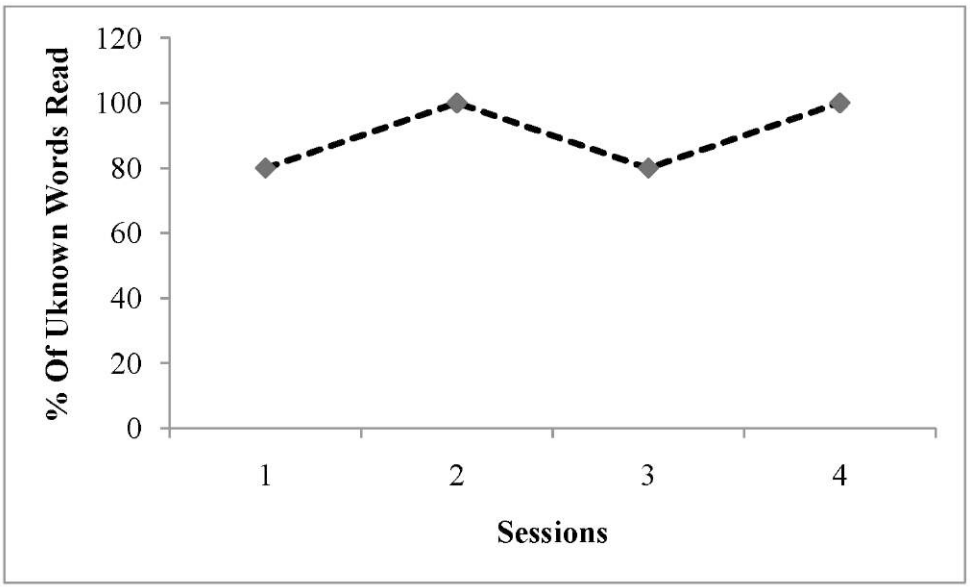

Figure 5 displays the words read correctly during the post-assessment for Participant 1. The words were the unknown words from the pre-assessment. The participant retained four out

of five words (80%) during from both the baseline and reversal baseline phases. The participant was able to read five out of five (100%) words accurately during both the first intervention and second intervention phases.

Figure 6

Participant 2's unknown words read correct during the post-assessment

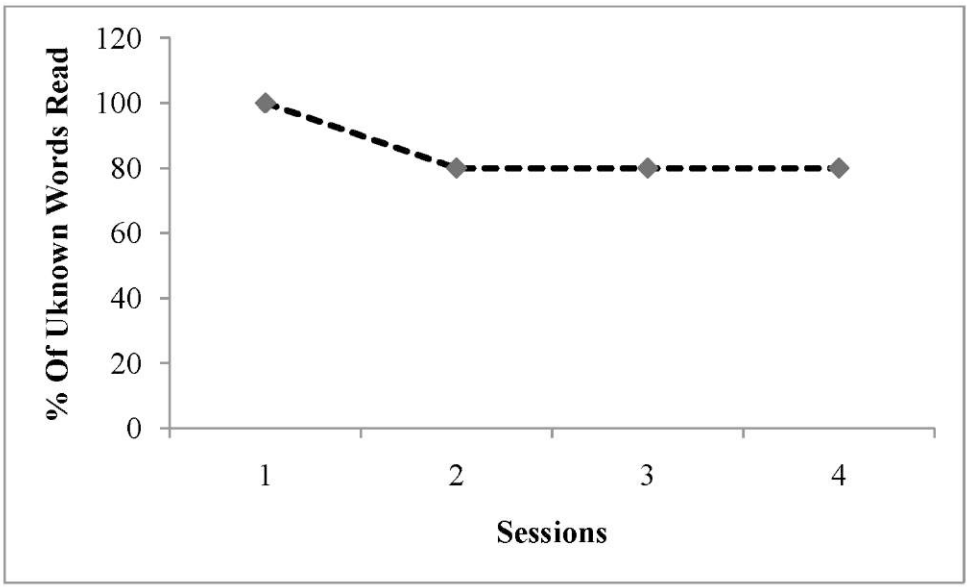

Figure 6 displays the words read correctly during the post-assessment for Participant 2. The words came from words read incorrectly during the pre-assessment. He read words from the first and second baseline phases with 100% and 80% accuracy respectively. Words from both treatment phases were read with 80% accuracy.

Figure 7

Participant 3's unknown words read correct during the post-assessment

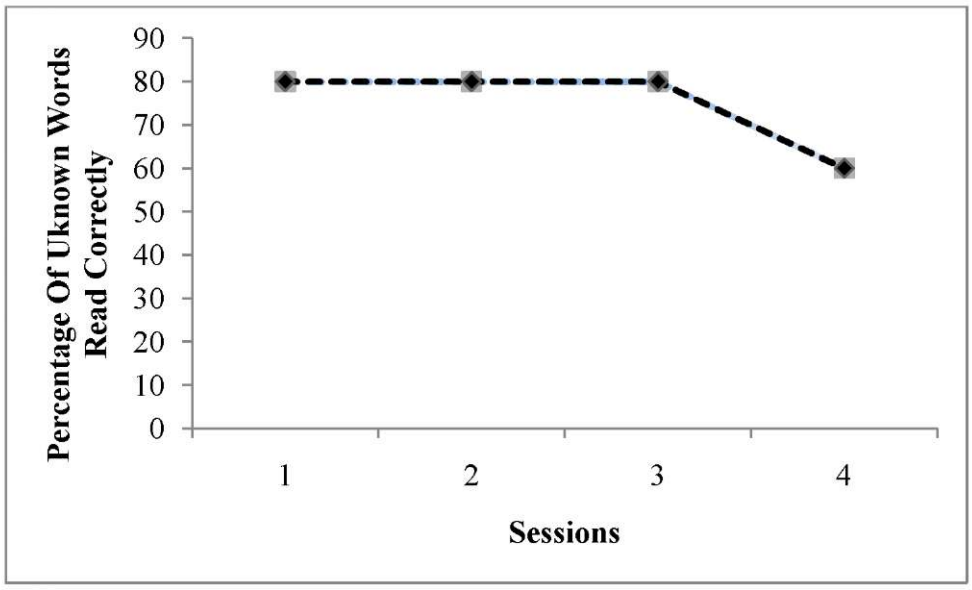

Figure 7 displays the words read correctly during the post-assessment for Participant 3. The words came from words read incorrectly during the pre-assessment. She read with 80% accuracy on both baseline phases and the initial treatment phase. She read with 60% accuracy for words from the second treatment phase.

Figure 8

Participant 4's unknown words read correct during the post-assessment

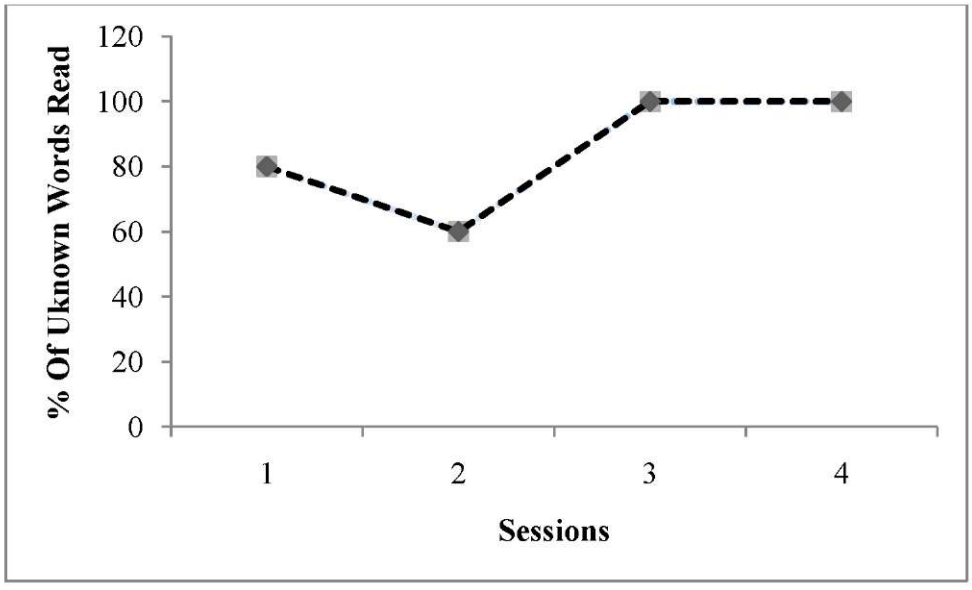

Figure 8 displays the words displays the words read correctly during the post-assessment for Participant 4. The words came from words read incorrectly during the pre-assessment. He read words with 80% accuracy from the baseline phase and 100% accuracy from the reversal baseline phase. He had 60% accuracy on words from the first treatment phase and 100% accuracy on words from the second treatment phase.

Summary

Two second grade students and two third grade students participated in all phases of the study. Two students received special education reading services under the Specific Learning Disability category and the other two students received special education reading services under the Other Health Disability and Developmental Cognitive Disability categories. All of the participants improved with sight word recognition during each phase. All participants had a higher percentage of daily words read correctly during the baseline phases as opposed to the intervention phases. Participant 1 read between eight and nine words correct on the last day of each phase. She averaged 80% to 100% words read correctly from the unknown words during the post-assessment. Participant 2 read between nine and 10 words correct on the last day of each phase. He averaged 80% to 100% on unknown words read correctly from the unknown words during the post-assessment. Participant 3 read between eight and 10 words correct on the last day of each phase. She read unknown words correctly from the post-assessment phase with 60% to 80% accuracy. Participant 4 read between eight and 10 words correct on the last day of each phase. He read unknown words correctly from the post-assessment phase with 60% to 100% accuracy.

Chapter V

Discussion

Summary

The purpose of this study was to determine if using the SMART board technology along with the interspersal of known items would enhance students' with cognitive and/or learning disabilities ability to learn and retain sight words. The study took place in an elementary school in Northern Minnesota. The participants included two second graders and two third graders. The four students included a boy and girl from each grade level. The students received daily special education services for reading services. The research question that guided this study was: *Will using the SMART Board technology utilizing interspersal of known items increase recognition of sight words with students with reading disabilities*?In order to address the research question, a quantitative, single subject design with the ABAB design was implemented when students learned sight words from the Dolch word lists using interspersal of known items and then adding the SMART Board technology with the approach. The following sub-question was also included in the study: *Will implementing interspersal of known items using the Smart Board technology increase the number of sight words students read correctly at a higher percentage as compared to using interspersal of known items alone?*

Results of Research Question

The current study used a ratio of 50% of known words to 50% of unknown words as recommended by Schmidgall and Joseph (2007). Their study also found interspersal of known items to be effective in teaching words. As with the present study, Joseph and Nist (2006) found

students' ability to learn new words increased with the interspersal of known items. Their participants were also successful with drill and practice. They found the participants learned more new words when they were given more known words with their unknown words. Future studies may also want to include a higher rate of known words to unknown words.

The SMART board is an intervention that has not been adequately studied for its ability to impact reading skills. The research question asked if using the SMART Board technology would increase recognition of sight words in combination with the interspersal of known items. The SMART Board technology did increase sight word recognition for all four participants, however, the data do not support that the increase was solely based on the SMART Board technology. Similar to this study, Mechling et al., (2007) studied the differences between SMART Board technology and flash cards. That study used the 3-second constant time delay where the present study incorporated the interspersal of known items. Both studies had similar findings when the SMART Board was effective for teaching words to students with disabilities. In addition, neither study found higher success with the SMART Board technology as opposed to the flash cards. In the Mechling et al., (2007) study, two of the students were able read 100% of both their SMART Board and flash card target words. The third student had a mean of 66.7% of her SMART Board target words and a mean of 62.5% of her flash card target words.

In the current study, Participant 1 had a higher average of words read correctly during the weeks using the flash cards as opposed to the weeks using the SMART Board. The number of words read correctly during the baseline phases and the initial treatment phase were all the same (nine out of 10), however, the number of words read correctly on the final day of the second treatment phase was 10 out of 10. Participant 2 read with 90% and 95% accuracy during the weeks with the flash cards and 90% accuracy and 77.5% accuracy when using the SMART

board. He read 10 out of 10 words correctly on the final day of the first three weeks of the study. He read nine out of 10 words correctly on the last day of the fourth week of the study. Participant 3 read with higher accuracy on both baseline phases of the flash cards as opposed to the phases with the SMART Board. On the final day of her baseline phases, she read more words correctly than the final day of the intervention phases. Participant 4 averaged 86% accuracy and 100% accuracy during the weeks with the flash cards. He read with 82.5% accuracy and 90% accuracy during the weeks with the SMART Board. On the final day of baseline phase he read nine words correct and 10 words correct on the last day of the reversal baseline. He read eight words and 10 words correctly on the last day of the first intervention phase and last intervention phase respectively. It is not a surprise the participants did not carry over of the retention of words from day to day or during the post-assessment as it is typical for students with learning disabilities to know something one day but not remember it the following day.

Browder and Shear (1996) found teaching weather related words using the interspersal of known items to be successful. Similar to that study, the present study also found the interspersal of known words to be effective when teaching sight words to students with disabilities. The interspersal of known items was successful in all phases of the current study. Cates et al., (2003) found the interspersal of known items to be an efficient strategy, too, when teaching students spelling words. The study compared the interspersal of known items to drill and practice for spelling words. The drill and practice was more efficient than the interspersal of known items. Efficiency was not a factor in the current study. Future studies may wish to incorporate efficiency between SMART Board technology and flash cards.

Results of Sub-question

Although students demonstrated an increase of their sight word recognition utilizing the SMART Board technology, the results of this research study do not support the sub-question regarding learning sight words at a higher rate with the SMART Board than with the interspersal of known items alone. Similar to the Mechling, et al., (2007) study, the students demonstrated an improvement of their word recognition with the SMART Board and with the flash cards. Students did not learn at a higher rate with the SMART Board than with the flash cards. In the Mechling, et al., (2007) study, two students read 100% of their SMART Board and flash card words. The third student was able to read over 65% of the SMART Board words and over 62% of the flash card words.

The students in the present study all demonstrated an increase of word recognition using both the flash cards with the interspersal of known items strategy and with the SMART Board technology with the interspersal of known items strategy. They did not increase their word recognition at a higher percentage with the SMART Board technology than with the interspersal of known items alone. Participant 1 had a higher percentage (100%) of learning sight words with the SMART Board technology than with the interspersal of known items alone (80%); however, when looking at the data the difference between the scores was only two more words read correctly from the SMART Board phases as opposed to the baseline phases. Participant 2 had a higher percentage for reading words correctly from the initial baseline than words read correctly from the SMART Board phases. Participant 3 read with words with 100% accuracy from the baseline phases and initial SMART board phase. She dropped to 80% accuracy on

words from the final SMART Board phase. Participant 4 read with 80% accuracy on words from the baseline phase and 60% accuracy on the initial SMART Board phase. He read with 100% accuracy on words from the reversal baseline phase and final SMART Board phase.

Limitations

There are several potential limitations to this study that should be taken under consideration. One possible limitation was the limited number of participants in the study. Four participants were included in the study, with such small numbers it is difficult to generalize across students. This will also limit the amount of information gathered during the phases. Another possible limitation was the shortened weeks of the intervention phases. During both baseline phases, data were collected five days. The intervention phases only had four days of data collection. If the participants had practiced their words one more day during each of the intervention phases, then they may have possibly had better scores on their final day of reading the words on the SMART Board. The additional day may have also helped the participants learn and retain their words better when the read those words on the post-assessment.

Another limitation may be the length of time between the beginning of the study and the end of the study. Students were assessed the week prior to the initial baseline phase. The words introduced during the first two phases took place three to four weeks before the participants were assessed after the four phases. The words introduced during the last two phases were only one or two weeks before the post-assessment. The time could have played a part of how well students remembered words. As noted earlier there participants have difficulty with remembering information with is typical to students with learning disabilities. The words in this study may have been a limitation. The words came from the Dolch pre-primer to fourth list. Second and

third grade students would have been exposed to the Dolch pre-primer and primer words in kindergarten and first grade, so even though they may have read the words incorrectly during the pre-assessment the words may be words they knew or were exposed to at some time.

Suggestions for Future Research

The results of this study suggest a number of future directions for research aimed at SMART Board technology. Future research may increase the number of words included in the study. Schmidgall and Joseph (2007) suggest using a 50% to 50% known to unknown ratio. The number of words may increase to twenty per phase, but they should continue to be equal number of known and unknown words. Future research may also include changing the technique of utilizing the SMART Board. The participants may be expected to have more interaction with the SMART Board such as copying and pasting the words instead of just touching the word prior to moving on to the next word.

The participant sample in the current study was limited to four participants. Future research should include a larger participant sample. A larger sample would give the researcher a wider group to compare and would be more representative of students with disabilities. A control group of students without disabilities may want to be included in further studies. Another researcher may want to include participants with a variety of disabilities. Future studies may also want to assess words that students would not necessarily have been exposed to such as the participants had in this study with the Dolch word lists. It should be recognized that in this study, the researcher observed the participants being much more excited to use the SMART Board technology as opposed to the flash cards. The participants often asked if it was their week to use the SMART Board. When it was their turn to use the SMART Board, they said they liked

using the SMART Board more than the flash cards. Studies in the future may want to include some form of survey to document the participants' feelings towards the use of the SMART Board compared to using the flash cards.

Summary

In summary, the SMART Board technology along with the interspersal of known items did enhance students' with cognitive and/or learning disabilities ability to learn and retain sight words. The SMART Board technology did not, however, increase the participant's ability to learn and retain sight words at a higher rate than the interspersal of known items alone. Participants were increased their sight word knowledge, but at times they did so at a higher rate with the interspersal of known items alone than with the SMART Board technology. More research conducted on this topic may give a better indication if SMART Board technology would be more effective with interspersal of known items than with the interspersal of known items alone.

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APPENDIX A

SCHOOL DISTRICT APPROVAL LETTER

INDEPENDENT SCHOOL DISTRICT NO. 700

Hermantown Elementary School

5365 W. ARROWHEAD ROAD • HERMANTOWN, MINNESOTA 55811-3615

(218) 729-6891 / FAX (218) 729-9870

DEB TABOR, PRINCIPAL

August 12, 2009

To whom it may concern:

This is to inform you that I approve of the research that Rebecca Nisius plans to conduct during the 2009-2010 school year at Hermantown Elementary School. Her research on the Smart Board effects on sight work knowledge with students will serve as important information for our staff also.

Please feel free to contact me if you require further information.

Thank you.

Sincerely,

Debra Tabor
Principal
Hermantown Elementary School

APPENDIX B

IRB APPROVAL LETTER

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Human Research Protection Program
Office of the Vice President for Research

D538 Mayo Memorial Building
420 Delaware Street S.E.
MMC 820
Minneapolis, MN 55455

Office: 612-625-1650
Fax: 612-626-6661
E-mail: irb@umn.edu or ihrpp@umn.edu
Website: http://research.umn.edu/subjects/

January 25, 2010

"Rebecca M Nisi us
5965 South Pike Lake Road
Duluth, MN 55811-9627

RE: "That Effects of the SMART Board Technology Utilizing lnterspersal of Known Items on Sight Word Recognition of Students with Reading Disabilities"
TRB Code Number: **0911P74074**

Dear Dr. Nisius

The Institutional Review Board (1RB) received your response to its stipulations. Since this information satisfies the federal criteria for approval at 45CFR46.111 and the requirements set by the IRB, final approval for the project is noted in our files. Upon receipt of this letter, you may begin your research.

IRB approval of this study includes the consent form received January 20, 2010 and recruitment materials received January 20, 2010.

The TRB would like to stress that subjects who go through the consent process are considered enrolled participants and are counted toward the total number of subjects, even if they have no further participation in the study. Please keep this in mind when calculating the number of subjects you request. This study is currently approved for 4 subjects. If you desire an increase in the number of approved subjects, you will need to make a formal request to the IRB.

For your records and for grant certification purposes, the approval date for the referenced project is November 18, 2009 and the Assurance of Compliance number is FWA000003 12 (Fairview Health Systems Research FWA00000325, Gillette Children's Specialty Healthcare FWA00004003). Research projects are subject to continuing review and renewal, approval will expire one year from that date. You will receive a report form two months before the expiration date. If you would like us to send certification of approval to a funding agency, please tell us the name and address of your contact person at the agency.

As Principal Investigator of this project, you are required by federal regulations to:
*Inform the IRB of any proposed changes in your research that will affect human subjects, changes should not be initiated until written IRB approval is received.
*Report to the IRB subject complaints and unanticipated problems involving risks to subjects or others as they occur.
•"Respond to notices for continuing review prior to the study's expiration date.
*Cooperate with post-approval monitoring activities.

Information on the TRB process is available in the form of a guide for researchers entitled, What Every Researcher Needs to Know, found at
http://www.research.umn.edu/irb/WERNK/index.cfm

The 1RB wishes you success with this research. If you have questions, please call the 1RB office at 612-626-5654.

We have created a short survey that will only take a couple of minutes to complete. The questions are basic, but will give us guidance on what areas are showing improvement and what areas we need to focus on:

https://umsurvey.umn.edu/index.php?sid=36122&lang=um

Sincerely,

Felicia Mroczkowski, CLP
Research Compliance Supervisor
FM/pm
CC: MaryMarchel

APPENDIX C

PHONE SCRIPT

Phone Script for Consent and Assent

Phone script for Consent

Hello "Mrs. Smith." This is Becca Nisius, special education teacher from Hermantown Elementary School. I am calling you today to tell you about a study I will be conducting this fall with some students and would like to invite to be involved in my study. This study is part of my requirements for my master's of special education program at UMD. I would like to invite John because he receives reading support in the resource room and because of his (Learning Disability, Cognitive Disability or Other Health Impaired Disability). The study will include sight word from the Dolch sight word lists which are words John was working on with me last year. He will be reading flash cards which is routine to our regular reading instruction. We will also be using the SMART Board to review and learn new sight words. The SMART Boards are the big white boards in some of the classrooms where students can interact with them by touching the screen to move things. The risks of this study are minimal as John is familiar with the tasks in the study. They are routine activities he generally does, so he would feel comfortable and familiar. Benefits of his involvement in the study include the activities that will potentially enhance his reading skills. John's participation in the study will not interfere with his regular instruction and services. I want you to know this is your decision to have "John" be a part of this study. You may decline to have him be involved in the study. You may also withdraw him from the study at any time with no negative consequences. Your decision will have no affect on his special education programming, Individualized Education Plan or grades. If you are interested in the study I will send you a consent letter explaining the study again. If you agree to the study I would need to have your signed permission returned. At that time I

would invite John to participate in the study. He also has the right to refuse or withdraw at any time without any consequences. Do you have any questions?

Phone script for assent:

Hello John. Do you remember I told you I am taking classes at UMD to learn to be a better teacher? One thing I am doing for my class is trying new ways to teach students to become better readers. I want to tell you about something I will be doing with some other students and want to invite you to participate with the activities if you want to, too. One activity would include you reading lists of sight words for me to see what words you already know and what words you need to work on a little more. Then we would use flash cards to work on the sight words. After awhile instead of using the sight words we would use the SMART Board. Do you remember using the SMART Board in your classroom or in computer class? At the end of the study you would read lists of sight words to me again to see how many more words you learned. During the study if you get tired or frustrated you can take a break until you are ready to work again. You can decide if you want to be part of this study and whatever you decide is ok with me and nothing will be held against you if you don't want to be part of the study. If you decide to be part of the study you can chose to stop participating at any point and that will be ok. If you want to be part of the study I have a sheet of paper to read to you and then you can sign it that you want to participate, too. Why would you want to be part of this study? Can you explain to me what you will do in this study? What would happen if you wanted to take a break or not continue with the study? Can you tell me how the activities might help with reading?

APPENDIX D

CONSENT FORM

CONSENT FORM

Your child is being invited to participate in a research study using SMART Board technology, along with a teaching strategy called "interspersal of known items," to increase the ability to read sight words for students who are in special education. Your child was selected as a possible participant because of his/her special education disability and he/she receives reading instruction in the special education resource room. I ask that you read this form and ask any questions you may have before agreeing to have your child be in the study.

This study is being conducted by: Rebecca Nisius, Graduate Student in the Education Department at University of Minnesota - Duluth.

Background Information

The purpose of this study is to determine if using SMART Board technology, along with a teaching strategy (interspersal of known items) that includes sight words the student both knows and does not know, will increase sight word knowledge for special education students with reading difficulties. This teaching strategy has been successful with students when teaching them math facts, spelling words and sight words. This study is important because there is not a lot of research completed on using the SMART Board technology with special education students as a teaching strategy. This study brings together the teaching strategy "interspersal of known items" with the SMART Board technology to determine if the use of the SMART Board technology enhances students' learning.

Procedures:

If you agree to have your child participate in this study, we would ask your child to do the following things. Participants will read a list of sight words from the Dolch sight word list at the beginning of the study in order to determine known and unknown words. (The Dolch sight word list is a list of common sight words from levels pre-reading to 3rd grade.) During each week of the study, your child will be asked to read ten different words each week. The ten words will include five words read correctly from the word list and five words read incorrectly from the word list. During the first and third week of the study, your child will read words on flash cards. I will show your child a flash card and listen to your child read it. Then I will record which words your child did or did not read correctly. During the second and fourth week of the study, your child will read sight words on the SMART Board. Your child will read a word out loud to me, and then touch the SMART Board screen in order to see the next word. After the fourth week of the study your child will read the sight words from the word list again. Your child will spend less than ten minutes each day during the four weeks reading the words. Your child will read the words to me in the special education resource room during his/her regular reading class time. If you choose not to have your child participate in the study, he/she will continue to work

on sight word recognition as described above, as sight word recognition is a part of his/her Individualized Education Plan. Your child's work/participation, however, will not be collected as data. If you choose to have your child participate in this study both, you and your child have a right to withdraw from the study at any time. All you would need to do to stop their participation in the study is contact me.

Risks and Benefits of being in the Study

The study has minimal risk for your child as the tasks for the study are similar to routine activities your child usually does and therefore your child should feel comfortable and familiar. Your child's participation in the study will not interfere with your child's regular class instruction, services and Individualized Education Plan.

Anticipated benefits to participation include improving your child's reading skills in the area of sight word recognition. Over the course of the study your child would be reviewing 20 known sight words and have the potential to learn 20 new sight words.

Compensation:

No compensation or reimbursement for the researcher, the parents or your child is included in this research study.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records. The records will be stored in a locked cabinet that only the researcher will have access to those records.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to have your child participate will not affect your or your child's current or future relations with the University of Minnesota or Hermantown School District. If you decide to have your child participate, you are free to not answer any question or withdraw at any time without affecting those relationships. If you decide to have your child participate in the study, you or your child has the right to stop participating in the study at any time.

Contacts and Questions:

The researcher conducting this study: Becca Nisius. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at Hermantown Elementary School, 218-729-6891, beccanisius@hermantown.k12.mn.us. You may also contact her advisor, Mary Ann Marchel, at 218-340-6655, mmarchel@d.umn.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature:_____Date: _____

Signature of parent or guardian: _____ Date: _____
(If minors are involved)

Signature of Investigator: _____ Date: ____

APPENDIX E

ASSENT FORM

Assent Form

I am asking if you are willing to try a new activity for learning sight words because I am trying to learn more about teaching sight words to my students. I am asking if you want to be in the study because you come to the resource room for your reading class. Some students are able to read lots of sight words without any help. Other students need a little extra help to learn some sight words. I hope that my new activity will help students who need a little extra help learn more sight words. I won't know if this new activity will work until I try it.

If you agree to be in this study, I will have you read a list of sight words to me. Then I will have you read ten different words to me. Five of the words you will know and five of the words will be words I want you to learn. The first week you will read the ten words using flash cards. The next week you will be using the SMART board to read ten different words. The following week you will read ten different words using flash cards again. Then the last week you will read ten different words using the SMART Board again. After that you will read the list of sight words to me again to see if my new activity with the SMART Board worked to help you learn more words.

You may not like the activity every day. The activity might not work as well as what you are doing now to learn sight words. If it does work, you may be able to learn a lot more sight words in the future.

You will still have the same reading teacher if you say no to be in this study. And, if you change your mind during the study during the study, you can always go back to the regular way you learn sight words. Being in the study is totally up to you, and no one will be mad at you if you don't want to do it.

You can ask any questions that you have about this study. If you have a question later that you don't think of now, you can ask me at any time.

Signing here means that you have read this paper or had it read to you and that you are willing to be in this study. If you don't want to be in this study, don't sign. Remember, being in this study is up to you, and no one will be mad at you if you don't sign this or even if you change your mind later.

Signature of participant

Signature of person explaining study

Date